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Architecture in Water

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Abstract: This paper deals with the understanding of what is architecture in water. The main aim is to understand its types, study its evolution, its scope in the current scenario, a brief study of construction techniques, sustainable approaches, problems faced while and after construction. At last, the aim is to arrive at a conclusion that why architecture in water is important.

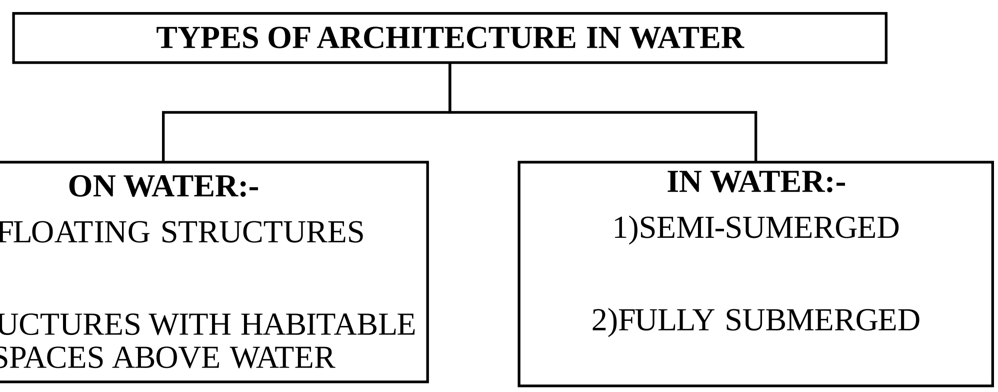
Keywords: Floating Architecture, VLFS, Steel Pantoon, Corrosion, Breakwaters.

INTRODUCTION

As life has evolved in water, mankind elementarily and inseparably connected to water. Water is a very important factor for human life and growth. The human body itself consists of 75% of water.

As architecture in water will flourish, a habitat will materialize for the first time worldwide which will set completely new standards of living. Man's farfetched imagination and curiosity to experience life in a completely new frontier have enabled him to establish landmarks in the field of architecture. Structures such as dwellings, cities, and aquariums, recreational facilities etc. .has been established under and over water which offers a unique environment for living and a whole new experience for people to enliven.

Architecture in water is the study of structures that can be constructed in and on water. Analyzing the construction of forts amidst water and underwater tunnels in history conclude that these ideas have always invited a man to explore the idea of habitat. In present context under water and on water, construction is very trending which enables the use of new technologies in the field of construction.
Some examples – The Palm Jumeirah, Dubai; Hydropolis, Dubai; Floating Island, South Korea.



ON WATER

1) FLOATING ARCHITECTURE
   It consists of various structures such as floating bridges, floating houses, floating roads which are kept afloat on the surface of water using various techniques and structural mechanisms.
   For e.g.: -Four Seasons hotel, Australia

2) STRUCTURES WITH HABITABLE SPACES ABOVE WATER:
   It consists of structures in which the main habitable area is on the water surface but the supporting foundations are submerged in water. Projects of various scales have been covered under this type.
   For e.g.: - City of Venice; Palm Jumeriah, Dubai etc.

IN WATER

1) SEMI-SUBMERGED
   It consists of structures in which major habitable space is under water and the rest is above water which caters to the various services like lighting, ventilation, etc.
   There are special mechanisms and techniques involved to keep the structures submerged.
   For e.g.: - Floating seashore villa, Dubai; Trilobis 65

2) FULLY SUBMERGED
   It consists of structures that are fully submerged in water. It includes structures such as tunnels, recreational spaces, aquariums, etc. It uses special mechanisms for ventilation, lighting and other services.
   For e.g.: - Hotel Hyropolis in Dubai.

EVOLUTION OF ARCHITECTURE IN WATER

The concept of architecture in water is not new. It has evolved over time. The new techniques have made it a better place for living. Humans always search for new frontiers of living and they search and develop those. Evolution has taken place from time to time and it is still evolving.

Some examples showing the evolution of architecture in water.

1) Venice

2) The Lake Palace, Udaipur

3) The houseboats of Kashmir

4) The Palm Island, Dubai

SCOPE IN CURRENT SCENARIO

This field of architecture has a great scope in the current scenario. As people are now searching for new frontiers of living and want new experiences, they want to have spaces in between water which gives a much more soothing and peaceful environment. Living spaces, recreational spaces in and under water are the need of tomorrow.

India is a country with huge coastal areas and large flood-prone areas. Public faces difficulty due to the floods and loss of lives and property. In this case, the concept of construction of floating houses should be adopted in which the structures would rise during floods and subside down during hot and dry conditions. This will reduce the loss of life and property. Therefore, research and development of new techniques of design and construction should be done. Structures in the flood-prone areas can be constructed with such techniques. These structures will function even during the period when there is no flood and these structures should be self-sufficient. Sustainable design techniques should be used. In coastal areas and islands, these structures will gain popularity sooner or later. Floating structures can also be built to increase tourism in India. It can generate a great amount of revenue for the country.

CONSTRUCTION TECHNIQUES

- **BIG BOAT SYSTEM**: Rather than designing a unique structure, seasteads could just purchase and retrofit a largely used vessel such as an oil tanker or cargo ship. Obtaining a used boat would reduce costs, and it would already contain many useful systems like propulsion and navigation. The propulsion could be used occasionally, although the ship would mostly save fuel. Large structures are less responsive to the waves than small ones safe.

- **SIMPLE PLATFORM SYSTEM*:*** In waters that are naturally calm or somehow protected, there are many simple systems that can be used to turn water into land. Each consists of some sort of buoyant base on which they put the desired structures. In an area without large waves, it would be quite cost effective and would be strongly measured as an alternate design.

- **LITTER BOTTLES*:*** It utilizes plastic 2-liter beverage bottles, which are extremely common, incredibly cheap, and resistant to seawater. These bottles can be banded together into hexagonal grids of 7 bottles each. The grids are then stacked and layered to form a buoyant lattice. Some sort of rigid surface then needs to be placed on top of the flotation

- **INVERTED CYLINDER:** Another simple technique is to have an inverted cylinder, open at the bottom, containing air. A disadvantage with open containers is that as depth increases, the air is compressed and displacement goes down. This flotation is cheap to manufacture and can be stacked for easy transport. Again, some sort of rigid platform needs to sit on these cells

- **CONCRETE SLABS*:*** These are hollow boxes of reinforced concrete, with enough buoyancy from the interior airspace to support the concrete as well as the structure. Its designs include shock-absorbing connectors, incorporated structural cleats and pile rings, and. Because the structures are monolithic and sealed, they cannot take on water and are unsinkable unless broken. And Ferro cement is cheap. Most floating homes used nowadays are built on such slabs. They'd be fairly easy to connect to one another, and small ones could be easily built on board. This is the most promising technology for protected waters.

- **BREAKWATERS:** A simple example of any breakwater is any island or reef, which acts as a natural barrier for its lee shore.
  TYPES:
  A) NATURAL BREAKWATERS
  Any landmass that reaches close to or above sea level acts as a natural breakwater. Rock is tough stuff, and it takes quite a while for the ocean to grind it into the sand. There are basically two options: we can shelter by a large landmass (which will almost certainly be inhabited), or a small one. Smaller breakwater includes atolls, reefs, and seamounts.

  B) ARTIFICIAL BREAKWATERS
  Mostly these rely on big pieces of concrete, although they're many alternative methods. Most designs are meant to rest on the seafloor. Ocean waves can be very large; hence a traditional design would need to be very large. The Palm Island has an artificial breakwater created by natural materials like large rocks and sand.

SUSTAINABLE ELEMENTS

- Self-supporting services such as desalination plant, sewage & waste treatment system.
- Power plant with at almost noiseless levels.
- Use of local raw materials.
- Geothermal use of sea water.

- Habitat creation of marine life by leftover stone.
- Daylight influx through transparent roof and columns
- Water cooling system by circulating the sea water through the floor, wall & roof.
- Use of solar energy.
- Bioclimatic building with an independent life-support system.
- Installation of solar cell/collector & wind turbine.
- Prefabricated frame for fast construction.
- Plastic composite material with characteristics of lighter, stronger, and economical to maintain.

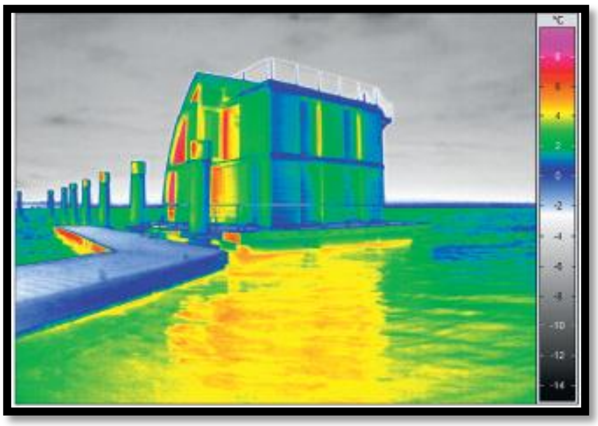
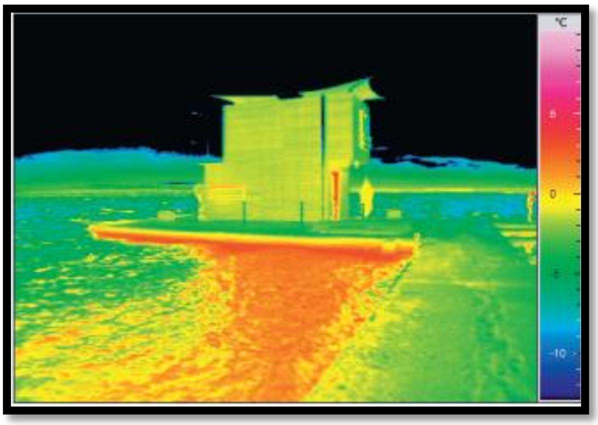
PROBLEMS FACED

1. **INDOOR CLIMATE**

   There is no problem in improving the heat insulation during the cold season even during strong winter climate, e.g. by an increased intensity of the wind. But during the summer season, innovative solutions are essential, in order to assure a moderate indoor climate.

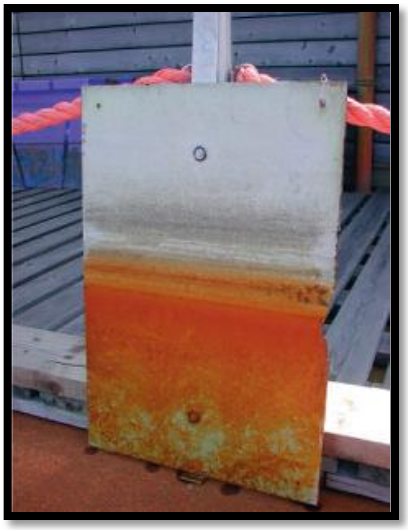
2. **THERMOGRAPHIC EXAMINATIONS**

   Water causes reflection of sun rays and heats up the surroundings. Uncomforting glare and heat are generated.
   The figures below show the water temperature due to sun rays and house temperature.

3. **CORROSION**
   Corrosion is caused by the extra impacts of chemical components of salts, ph-values, ions etc. The components of the local outdoor climate cause an intense corrosion of materials.

4. **STEEL PONTOON**
   Steel pontoons must be overcoated with an additional surfacing of high quality to avoid corrosion. The figure below shows the rusting of steel plate submerged in water.



5. ALGAE DEPOSITION

The microbiological growth on surfaces to improve the thermal insulation of covering parts of the buildings; the external surfaces tend to have a natural growth of algae.

6. DISTURBANCES IN AQUATIC LIFE

If proper planning of the structures on water is not done then, it harms and disturbs the aquatic life to a great extent.

CONCLUSION

From the above study, it is quite clear that architecture in water is a very interesting and innovative stream in architecture. It is the need of tomorrow. With the increasing climate change, it is very important for architects to start thinking of developing new frontiers of living.

People demand and want to have new experiences. Architecture in water has started to fulfill their needs and demands. Its evolution has taken place and it is still evolving. Although the structures face some problems but those problems can be reduced with proper designing and proper use of material.

In the Indian context, it is very necessary to develop architecture in water. In near future, cities will be so congested that people will demand to live on the water. Cities like Bombay should start working on these concepts and start executing them .sArchitecture in water is the future of architecture.

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